

August 17, 2017

Dr. Christopher Keane
Vice President for Research
Washington State University
Pullman, WA 99164-6525

SUBJECT: WASHINGTON STATE UNIVERSITY – U.S. NUCLEAR REGULATORY
COMMISSION ROUTINE INSPECTION REPORT NO. 50-027/2017-201

Dear Dr. Keane:

From July 17 - 20, 2017, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your Washington State University TRIGA research reactor located in the Nuclear Science Center. The enclosed report documents the inspection results, which were discussed on July 20, 2017, with Dr. Donald Wall, Director of the Nuclear Science Center, and members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel. Based on the results of this inspection, no findings of noncompliance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

C. Keane

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Should you have any questions concerning this inspection, please contact Mr. Gary Morlang at 301-415-4092 or electronic mail at Gary.Morlang@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-27
License No. R-76

Enclosure:
As stated

cc: w/enclosure: See next page

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COMMISSION ROUTINE INSPECTION REPORT NO. 50-027/2017-201
DATED: AUGUST 17, 2017

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Washington State University

Docket No. 50-027

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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No. 50-027

License No. R-076

Report No. 50-027/2017-201

Licensee: Washington State University

Facility: Nuclear Science Center

Location: Pullman, WA

Dates: July 17 - 20, 2017

Inspector: Gary Morlang

Approved by: Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Washington State University
Nuclear Science Center
NRC Report No. 50-027/2017-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the Washington State University (the licensee's) Class II research and test reactor safety program including: (1) operations logs and records, (2) surveillance and limiting conditions for operation, (3) experiments, (4) committees, audits and reviews (5) emergency preparedness, (6) maintenance logs and records, and (7) fuel handling since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements.

Operations Logs and Records

- Operational activities were consistent with applicable technical specifications (TSs) and procedural requirements.

Surveillance and Limiting Conditions for Operations

- The program for tracking and completing surveillance checks and limiting conditions for operation satisfied TS requirements.

Experiments

- Conduct and control of experiments and irradiations met the requirements specified in the TSs, the applicable experiment irradiation authorizations, and associated procedures.

Committees, Audits and Reviews

- The review and audit program was being conducted by the Reactor Safeguards Committee. The composition and meeting frequency satisfied requirements specified in the TSs.

Emergency Preparedness

- The Emergency Plan (E-Plan) and Implementing Procedures were being reviewed and updated as required.
- Emergency response facilities and equipment were being maintained as required and responders were knowledgeable of proper actions to be taken in case of an emergency.
- Off-site support was acceptable and communications capabilities were adequate.
- Annual drills were being conducted and critiques were being held as required by the E-Plan.

Maintenance Logs and Records

- Maintenance logs, records, performance, and reviews satisfied TSs and procedure requirements.

Fuel Handling

- Fuel handling activities and documentation were in compliance with the requirements specified in the TSs and procedures.

REPORT DETAILS

Summary of Facility Status

The Washington State University (WSU, the licensee's) one megawatt (MW) TRIGA research and test reactor continued normal, routine operations. A review of the applicable records indicated that the reactor was operated as needed in support of education, operator training, and irradiation of various materials. During the inspection, the reactor was operated at levels up to one MW and in accordance with applicable procedures to support ongoing irradiation activities.

1. Operations Logs and Records

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed selected aspects of the following to verify compliance with technical specification (TS) Section 6.2 and the applicable procedures:

- WSU U.S. Nuclear Regulatory Commission (NRC) TSs dated September 30, 2011
- Observation of selected operations activities on July 19, 2017
- Scram Summary Log (S.1) entries for 2016 and to date in 2017
- Pulsing Summary Log (S.2) entries for 2016 and to date in 2017
- Washington State University Nuclear Science Center (WSUNSC) Maintenance Log (O.8) from January 2016 to present
- Reactor Operating Log (O.1) sheets from January 2016 through July 14, 2017, entitled "WSU Nuclear Science Center Reactor Log," NRC Form Number (No.) 22, latest form revision (March 2015)
- Selected entries on Reactor Start-Up Check-off (O.3) forms entitled WSUNSC Form No. 34, "WSU Reactor Start-Up Check-off," latest form revision (October 2016) for 2016 and to date in 2017
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2015, through June 30, 2016, dated August 19, 2016
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2014, through June 30, 2015, dated August 7, 2015
- WSUNSC Administrative Procedure, Section No. 1, entitled "Responsibilities and Authority of Reactor Operating Staff," (not dated)
- WSUNSC Standard Operating Procedure (SOP) No. 1, "Standard Procedure for Use of the Reactor," (May 9, 2017)
- WSUNSC SOP No. 2, "Standard Procedure for Startup, Operation, and Shutdown of the Reactor," (May 9, 2017)

b. Observations and Findings

Enclosure

Reactor operations were carried out following written procedures and in accordance with TS requirements. Shift staffing satisfied the minimum requirements for duty and on-call personnel. Quarterly audits were conducted by Reactor Safeguards Committee (RSC) personnel. Accurate correlation between reactor logs, scram logs, pulse logs, and maintenance logs was noted. Equipment problems and events were well documented and resolved, with the senior reactor operator (SRO) approval if required for restart of the reactor.

c. Conclusion

The operational activities were found to be consistent with applicable TS and procedural requirements.

2. Surveillance and Limiting Conditions for Operations

a. Inspection Scope (IP 69001)

To verify compliance with TS Sections 3, 4, and 5, the inspector reviewed selected aspects of:

- Reactor Operating Log (O.1) sheets from January 2016 through July 2017, entitled "WSU Nuclear Science Center Reactor Log," NRC Form No. 22, latest form revision May 2017
- Control Element Inspection Log (O.5) for 2016 and 2017
- Monthly Core Reactivity Parameters Log (O.7) for 2016 thru July 2017
- Maintenance Log, Volume 1 (O.8), pages 148-158
- Preventative Maintenance Checklists (O.2) for 2016 and to date in 2017
- RSC meeting minutes for 2016 and 2017
- Power Calibration Log forms (also in O.2) for 2016 and to date in 2017
- Monthly Console and Auxiliary Equipment Checklist Log (O.9) containing documentation of equipment maintenance as indicated on the WSUNSC Form No. 40, entitled "Console Auxiliary Equipment Maintenance Checklist," latest form revision July 2016
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2015, through June 30, 2016, dated August 19, 2016
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2014, through June 30, 2015 dated August 7, 2015
- WSUNSC SOP No. 5, "Standard Procedure for Performing Preventive Maintenance," dated May 9, 2017
- WSUNSC SOP No. 11, "Standard Procedure for Control Element Maintenance, Removal, and Replacement," dated May 9, 2017
- WSUNSC SOP No. 20, "Standard Procedure for Performing Power Calibrations," dated May 9, 2017
- WSUNSC SOP No. 23, "Standard Procedure for Annual Fuel Inspection," dated May 9, 2017

- WSUNSC SOP No. 24, "Standard Procedure for Fuel Burnup Calculation," dated May 9, 2017
- WSUNSC SOP No. 25, "Standard Procedure for Core Changes and Fuel Movement," dated March 12, 2015

b. Observations and Findings

The Inspector determined that the daily, weekly, monthly, semiannual, annual, and other periodic checks, tests, and verifications for TS required limiting conditions for operation (LCO) were being completed as required. Extensive checklists were used to track completion of the various required surveillances and LCO verifications. The checklists included the date and name that each activity was completed. All recorded results observed by the inspector were within prescribed TSs and procedure parameters and in close agreement with the previous surveillance results.

c. Conclusion

The surveillance logs, records, performance, and reviews satisfied TSs and procedure requirements. The program for tracking and completing surveillance requirements was detailed and thorough.

3. Experiments

a. Inspection Scope (IP 69001)

To verify compliance with the licensee's program for conducting experiments and irradiations as outlined in TS Sections 3.6, 4.6, and 6.4.7 and in various procedures, the inspector reviewed selected aspects of:

- WSUNSC Irradiation Data Log sheets for the period from January 2016 to the present
- WSUNSC Reactor Operating Log (O.1) sheets from January 2016 to the present
- Experiment approvals documented on WSUNSC Form No. 1, entitled "Project Initiation Request Form," latest form revision dated March 2011, with the associated experiment overviews, safety reviews and analyses, isotope production data, accident analyses, and approvals
- SOP No. 1, "Standard Procedure For Use Of The Reactor," latest revision dated March 12, 2015
- SOP No. 2, "Standard Procedure For Startup, Operations and Shutdown of The Reactor," latest revision dated May 9, 2017
- SOP No. 3, "Standard Procedure For Performing Experiments Using The Reactor," latest revision dated May 9, 2017

b. Observations and Findings

Various new experiments had been proposed since the last inspection. The inspector verified that new experiments were reviewed and approved by a SRO and by either the Assistant Facility Director or the Facility Director. Certain experiments were also approved by the RSC when required. The inspector also verified that the experiments were completed under the supervision of the SRO and in accordance with TS requirements.

The inspector reviewed the existing experiment and irradiation authorization documents, Irradiation Data Log sheets, Reactor Logbook, and interviewed staff members. It was noted that the information typically entered on the Irradiation Data Log sheets was now being entered into a data base developed by facility personnel. The appropriate data was recorded and the radioactive material produced was handled and controlled as required.

c. Conclusion

The conduct and control of experiments and irradiations met the requirements specified in the TSs, the experiment irradiation authorizations, and applicable procedures.

4. Committees, Audits and Reviews

a. Inspection Scope (IP 69001)

In order to verify that the licensee had established and conducted reviews and audits as required in TS Section 6.4, the inspector reviewed selected aspects of:

- WSU RSC meeting minutes for 2016 and to date in 2017
- Safety review and audit records documented on WSUNSC forms entitled, "Reactor Safeguards Committee Facility Records Quarterly Audit," for the period from January 2016 through the present
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2015, through June 30, 2016, dated August 19, 2016
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2014, through June 30, 2015, dated August 7, 2015

b. Observations and Findings

The RSC membership satisfied TS requirements and the Committee's procedural rules. The RSC, or a subcommittee thereof, was required to hold semi-annual meetings each year. It was noted that three committee meetings were held in 2016, and two committee meetings to date in 2017.

Review of the committee meeting minutes indicated that the RSC provided appropriate guidance and direction for reactor operations. Additionally, the annual review of the radiation protection program and the biennial reviews of the

standard operating procedures, the emergency plan (E-Plan), and the security plan had been conducted and documented.

Since the last inspection, audits of reactor facility records and reviews of operating abnormalities, changes to procedures, equipment changes, and proposed tests or experiments had been completed and documented. The inspector noted that audits were conducted during the meetings held by the RSC.

c. Conclusion

The review and audit program was being completed acceptably by the RSC.

5. Emergency Preparedness

a. Inspection Scope (IP 69001)

To ensure that the licensee was acceptably implementing the various aspects of their emergency preparedness program, the inspector reviewed selected aspects of:

- WSUNSC SOP No. 15, "Standard Procedure for Action in the Event of an Alarm," dated May 9, 2017
- Emergency Preparedness Plan for the WSUNSC dated May 21, 2015
- Emergency drills and exercises for the past two years
- Administrative Requirements Schedule Log (A.4) sheets
- Training records for licensee staff and support personnel
- Emergency response facilities, supplies, equipment, and instrumentation
- Offsite support as documented in the Letter of Agreement with the hospital
- WSUNSC Short Form Emergency Procedure, latest revision dated November 21, 2008
- WSUNSC SOP No. 14, "Standard Procedure in the Event of an Emergency Situation," dated May 9, 2017

b. Observations and Findings

The E-Plan in use at the facility, entitled "Emergency Preparedness Plan for the Nuclear Science Center, Washington State University," was being reviewed and updated as required by TSs.

Emergency facilities, instrumentation, and equipment were being maintained and controlled, and supplies were being inventoried as required in the Emergency Preparedness Plan.

The Inspector determined through records review and through interviews with licensee personnel that emergency responders were knowledgeable of the proper actions to take in case of an emergency. The agreement with the Pullman Regional Hospital, which had been updated May 24, 2016.

Communications capabilities with the various campus, city, and county support groups were acceptable and off-site support for the facility was verified to be acceptable and in accordance with the Emergency Preparedness Plan. The alarm system had been tested weekly and monthly as stipulated in the Emergency Preparedness Plan.

The inspector determined that the emergency drills were being conducted as required by the Emergency Preparedness Plan. Critiques were written following the drills and they addressed problems noted during the conduct of the drill with assigned corrective actions.

c. Conclusion

The emergency preparedness program was conducted in accordance with the requirements stipulated in the E-Plan.

6. Maintenance Logs and Records

a. Inspection Scope (IP 69001)

To verify compliance with TS Sections 3, 4, and 5, the inspector reviewed selected aspects of:

- Reactor Operations Summary Sheets for 2016 and to date in 2017
- Control Element Inspection Log (O.5) for 2016 and to date in 2017
- Monthly Core Reactivity Parameters Log (O.7) for 2016 and to date in 2017
- Maintenance Log, Volume 1 (O.8), pages 148-158
- Preventative Maintenance Checklists (O.2) for 2016 and to date in 2017
- RSC meeting minutes 2016 and to date in 2017
- Power Calibration Log forms (also in O.2) for 2016 and to date in 2017
- Monthly Console and Auxiliary Equipment Checklist Log (O.9) containing documentation of equipment maintenance as indicated on the WSUNSC Form No. 40, entitled "Console Auxiliary Equipment Maintenance Checklist," latest form revision June 2016
- WSUNSC Reactor Operating Log (O.1) sheets from January 2016 to date in 2017
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2015, through June 30, 2016, dated August 19, 2016
- WSU Annual Report entitled "Annual Report on the Operation of the Washington State University Nuclear Radiation Center TRIGA Reactor," for the periods from July 1, 2014, through June 30, 2015, dated August 7, 2015
- WSUNSC Administrative Procedure, Section No. 5, entitled "Surveillance Documentation Review," (not dated)
- WSUNSC Administrative Procedure, Section No. 6, entitled "Performance of Maintenance Activities," (not dated)
- WSUNSC SOP No. 5, "Standard Procedure for Performing Preventive Maintenance," dated May 9, 2017

- WSUNSC SOP No. 11, "Standard Procedure for Control Element Maintenance," dated May 9, 2017
- WSUNSC SOP No. 20, "Standard Procedure for Performing Power Calibrations," dated May 9, 2017

b. Observations and Findings

The Inspector noted that routine and preventive maintenance was controlled by, and documented in, the maintenance or reactor operations logs and the monthly Console Auxiliary Equipment Maintenance Checklists consistent with the TSs and licensee procedures. Unscheduled maintenance or equipment repair was reviewed to determine if the work required a Title 10 of the *Code of Federal Regulations* 50.59 evaluation. Verifications and operational systems checks were performed following completion of the maintenance to ensure system operability before the equipment was returned to service.

c. Conclusion

The maintenance logs, records, performance, and reviews satisfied TSs and procedure requirements.

7. **Fuel Handling**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to ensure that the licensee was complying with TS Sections 4.1.6, 5.2, 6.8, and 6.9:

- Control Element Inspection Log (O.5) for 2016 and 2017
- Monthly Core Reactivity Parameters Log (O.7) for 2016 and 2017
- Core Change Log (O.6) through July 2017
- Fuel handling equipment and instrumentation
- Selected WSUNSC Reactor Log sheets from 2016 through the present
- WSU special nuclear material Physical Inventory Log sheets dated March 21, 2012, from 2016 through the present
- WSUNSC Administrative Procedure, Section No. 9, entitled "Special Nuclear Material Accountability Plan," (not dated)
- WSUNSC SOP No. 23, "Standard Procedure Annual Fuel Inspection," dated May 9, 2017
- WSUNSC SOP No. 11, "Standard Procedure for Control Element Maintenance," dated May 9, 2017

b. Observations and Findings

Procedures for refueling, fuel movement, and TSs required surveillances ensured controlled operations for Core 35-A. A detailed plan for performing fuel movement was required to be developed prior to each fuel movement operation.

The inspector noted that the data recorded for fuel movements that had been conducted in the past were acceptable and were required to be cross referenced in the operations logs. Log entries, indicating fuel movements, were completed under the direct supervision of a SRO as required.

Through records review and interviews with licensee personnel, the inspector determined that various fuel movement operations had been conducted since the last inspection in this area. The most significant fuel movement involved removing fuel bundles from the core to allow for fuel inspection in January 2016. The inspector verified that a detailed plan had been completed for the fuel movement activities as required. The plan had been reviewed and approved by the Facility Assistant Director and the Facility Director as required.

c. Conclusion

The fuel handling activities and documentation were as required by facility TSs and procedures.

8. Exit Interview

The inspection scope and results were summarized on July 20, 2017, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. The licensee acknowledged the inspection results presented and did not identify as proprietary any of the material provided to or reviewed by the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

C. Hines	Assistant Director, Nuclear Science Center
T. LaVoie	Senior Reactor Operator
D. Wall	Director, Nuclear Science Center
H. Bennet	Senior Reactor Operator
C. Jackson	Administrative Assistant

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
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ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

PARTIAL LIST OF ACRONYMS USED

E-Plan	Emergency Plan
IP	Inspection Procedure
LCO	Limiting Condition for Operation
MW	Megawatt
No.	Number
NRC	U.S. Nuclear Regulatory Commission
RSC	Reactor Safeguards Committee
SOP	Standard Operating Procedure
SRO	Senior Reactor Operator
TS	Technical Specification
WSU	Washington State University
WSUNSC	Washington State University Nuclear Science Center